FAIRCHILD SEMICONDUCTOR®

June 2008

# FJI5603D
# NPN Silicon Transistor

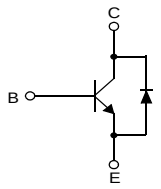
## Applications

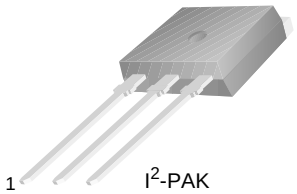
- High Voltage and High Speed Power Switch Application
- Electronic Ballast Application

## Features

- Wide Safe Operating Area
- Small Variance in Storage Time
- Built-in Free Wheeling Diode

Equivalent Circuit




$I^2$-PAK

1.Base 2.Collector 3.Emitter

## Absolute Maximum Ratings* $T_a$ = 25°C unless otherwise noted

| Symbol | Parameter | Ratings | Units |
|---|---|---|---|
| $BV_{CBO}$ | Collector-Base Voltage | 1600 | V |
| $BV_{CEO}$ | Collector-Emitter Voltage | 800 | V |
| $BV_{EBO}$ | Emitter-Base Voltage | 12 | V |
| $I_C$ | Collector Current(DC) | 3 | A |
| $I_{CP}$ | Collector Current(Pulse)** | 6 | A |
| $I_B$ | Base Current | 2 | A |
| $I_{BP}$ | Base Current(Pulse)** | 4 | A |
| $P_D$ | Power Dissipation($T_C$=25°C) | 100 | W |
| $T_J$ | Junction Temperature | 150 | °C |
| $T_{STG}$ | Storage Junction Temperature Range | - 65 ~ +150 | °C |
| EAS | Avalanche Energy($T_j$=25°C, 8mH) | 3.5 | mJ |

* These ratings are limiting values above which the serviceability of any semiconductor device may be impaired.

** Pulse Test : Pulse Width = 5ms, Duty Cycle ≤ 10%

## Thermal Characteristics* $T_a$=25°C unless otherwise noted

| Symbol | Parameter | Ratings | Units |
|---|---|---|---|
| $R_{\theta jc}$ | Thermal Resistance, Junction to Case | 1.25 | °C/W |
| $R_{\theta ja}$ | Thermal Resistance, Junction to Ambient | 80 | °C/W |

* Device mounted on minimum pad size

## Ordering Information

| Part Number | Marking | Package | Packing Method | Remarks |
|---|---|---|---|---|
| FJI5603DTU | J5603D | I2PAK | TUBE | |

## Electrical Characteristics* $T_a$=25°C unless otherwise noted

| Symbol | Parameter | Test Condition | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| $BV_{CBO}$ | Collector-Base Breakdown Voltage | $I_C$=0.5mA, $I_E$=0 | | 1600 | 1689 | | V |
| $BV_{CEO}$ | Collector-Emitter Breakdown Voltage | $I_C$=5mA, $I_B$=0 | | 800 | 870 | | V |
| $BV_{EBO}$ | Emitter-Base Breakdown Voltage | $I_E$=0.5mA, $I_C$=0 | | 12 | 14.8 | | V |
| $I_{CES}$ | Collector Cut-off Current | $V_{CES}$=1600V, $I_E$=0 | $T_C$=25°C | | 0.01 | 100 | μA |
| | | | $T_C$=125°C | | | 1000 | |
| $I_{CEO}$ | Collector Cut-off Current | $V_{CE}$=800V, $V_{BE}$=0 | $T_C$=25°C | | 0.01 | 100 | μA |
| | | | $T_C$=125°C | | | 1000 | |
| $I_{EBO}$ | Emitter Cut-off Current | $V_{EB}$=12V, $I_C$=0 | | | 0.05 | 500 | μA |
| $h_{FE}$ | DC Current Gain | $V_{CE}$=3V, $I_C$=0.4A | $T_C$=25°C | 20 | 29 | 35 | |
| | | | $T_C$=125°C | 6 | 15 | | |
| | | $V_{CE}$=10V, $I_C$=5mA | $T_C$=25°C | 20 | 43 | | |
| | | | $T_C$=125°C | 20 | 46 | | |
| $V_{CE}$(sat) | Collector-Emitter Saturation Voltage | $I_C$=250mA, $I_B$=25mA | $T_C$=25°C | | 0.5 | 1.25 | V |
| | | $I_C$=500mA, $I_B$=50mA | $T_C$=25°C | | 1.5 | 2.5 | V |
| | | $I_C$=1A, $I_B$=0.2A | $T_C$=25°C | | 1.2 | 2.5 | V |
| $V_{BE}$(sat) | Base-Emitter Saturation Voltage | $I_C$=500mA, $I_B$=50mA | $T_C$=25°C | | 0.74 | 1.2 | V |
| | | | $T_C$=125°C | | 0.61 | 1.1 | |
| | | $I_C$=2A, $I_B$=0.4A | $T_C$=25°C | | 0.85 | 1.2 | V |
| | | | $T_C$=125°C | | 0.74 | 1.1 | |
| $C_{ib}$ | Input Capacitance | $V_{EB}$=10V, $I_C$=0, f=1MHz | | | 745 | 1000 | pF |
| $C_{ob}$ | Output Capacitance | $V_{CB}$=10V, $I_E$=0, f=1MHz | | | 56 | 500 | pF |
| $f_T$ | Current Gain Bandwidth Product | $I_C$=0.1A,$V_{CE}$=10V | | | 5 | | MHz |
| $V_F$ | Diode Forward Voltage | $I_F$=0.4A | | | 0.76 | 1.2 | V |
| | | $I_F$=1A | | | 0.83 | 1.5 | V |

* Pulse Test: Pulse Widt=20μs, Duty Cycle≤10%

## Electrical Characteristics $T_C$=25°C unless otherwise noted

| Symbol | Parameter | Test Condition | Min | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| RESISTIVE LOAD SWITCHING (D.C ≤ 10%, Pulse Width=20μs) | | | | | | |
| $t_{ON}$ | Turn On Time | $I_C$=0.3A, $I_{B1}$=50mA $I_{B2}$=150mA $V_{CC}$=125V $R_L$ = 416Ω | | 400 | 600 | ns |
| $t_{STG}$ | Storage Time | | 1.9 | 2.1 | 2.3 | μs |
| $t_F$ | Fall Time | | | 310 | 1000 | ns |
| $t_{ON}$ | Turn On Time | $I_C$=0.5A, $I_{B1}$=50mA, $I_{B2}$=250mA $V_{CC}$=125V, $R_L$ = 250Ω | | 600 | 1100 | ns |
| $t_{STG}$ | Storage Time | | | 1.3 | 1.5 | μs |
| $t_F$ | Fall Time | | | 180 | 350 | ns |
| INDUCTIVE LOAD SWITCHING ($V_{CC}$=15V) | | | | | | |
| $t_{STG}$ | Storage Time | $I_C$=0.3A, $I_{B1}$=50mA$I_{B2}$=150mA, Vz=300V, $L_C$=200H | 0.8 | - | 1.2 | μs |
| $t_F$ | Fall Time | | | 170 | 250 | ns |
| $t_C$ | Cross-over Time | | | 180 | 250 | ns |
| $t_{STG}$ | Storage Time | $I_C$=0.5A, $I_{B1}$=50mA, $I_{B2}$=250mA, Vz=300V, $L_C$=200H | 0.8 | - | 1.2 | μs |
| $t_F$ | Fall Time | | | 140 | 175 | ns |
| $t_C$ | Cross-over Time | | | 170 | 200 | ns |

# Typical Characteristics

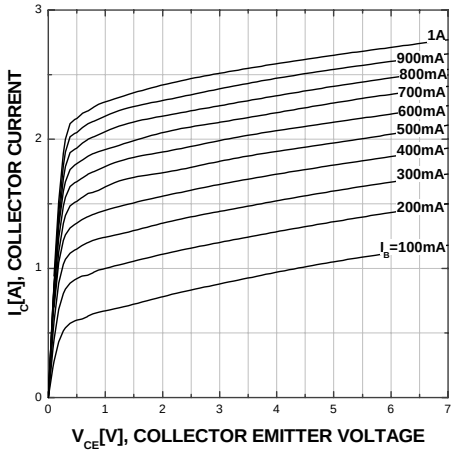



**Figure 1. Static Characteristic**

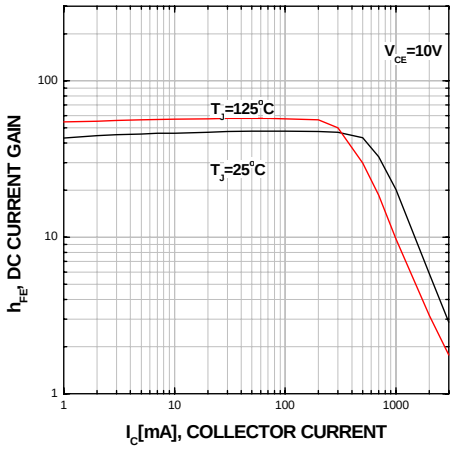



**Figure 2. DC current Gain**

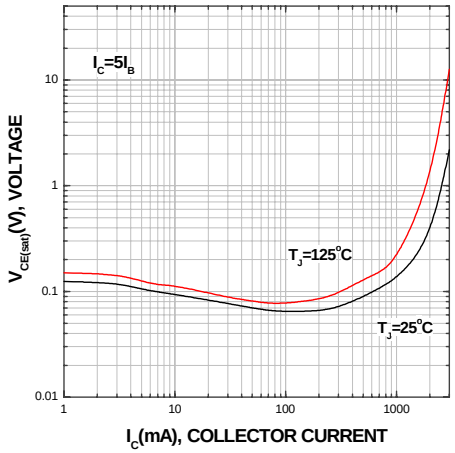



**Figure 3. Collector-Emitter Saturation Voltage**

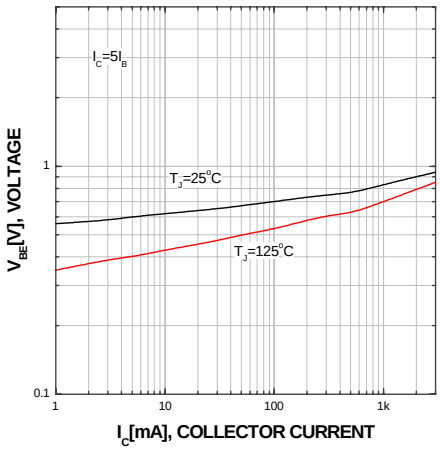



**Figure 4. Base-Emitter Saturation Voltage**

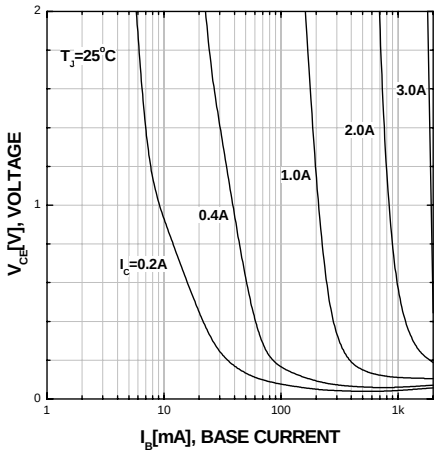



**Figure 5. Typical Collector Saturation Voltage**

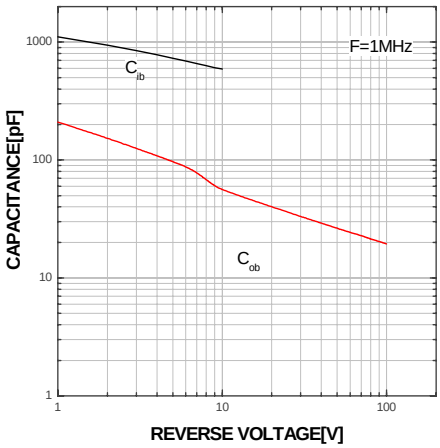



**Figure 6. Capacitance**

## Typical Characteristics (Continued)

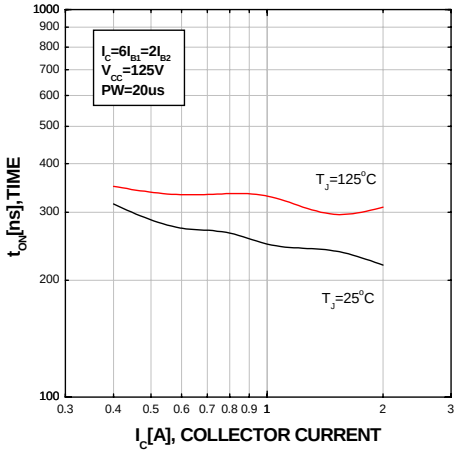



**Figure 7. Resistive Switching Time, $t_{on}$**

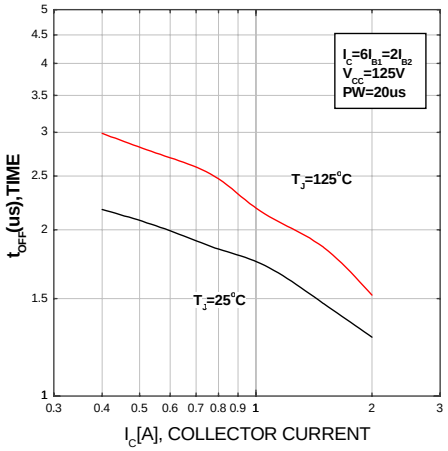



**Figure 8. Resistive Switching Time, $t_{off}$**

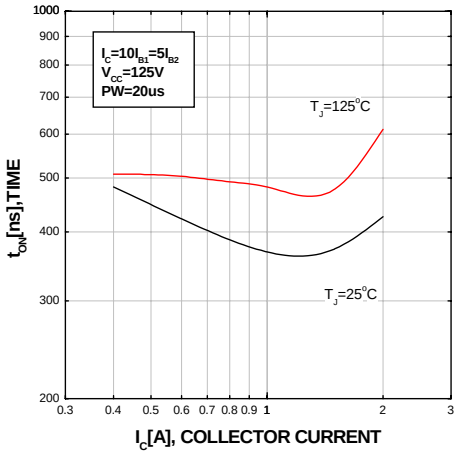



**Figure 9. Resistive Switching Time, $t_{on}$**

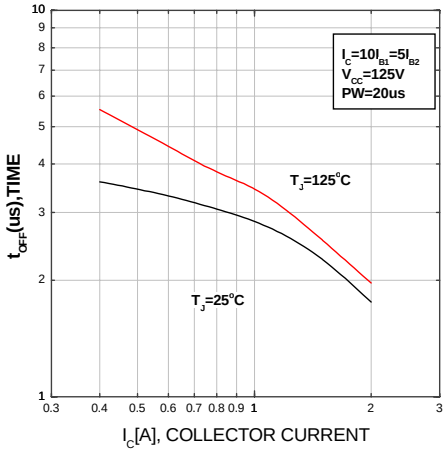



**Figure 10. Resistive Switching Time, $t_{off}$**

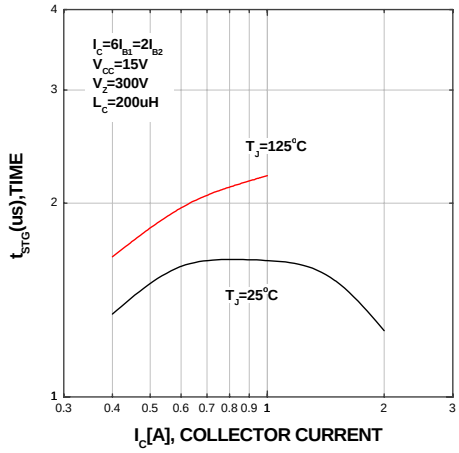



**Figure 11. Inductive Switching Time, $t_{STG}$**

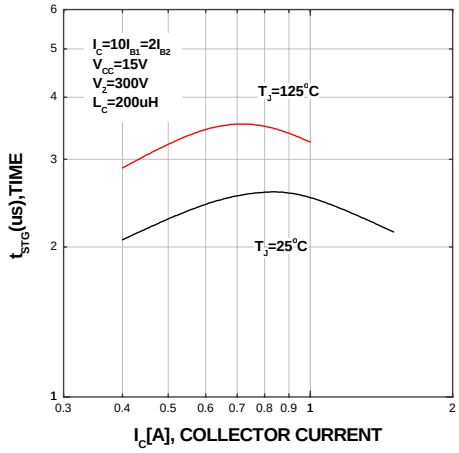



**Figure 12. Inductive Switching Time, $t_{STG}$**

## Typical Characteristics (Continued)

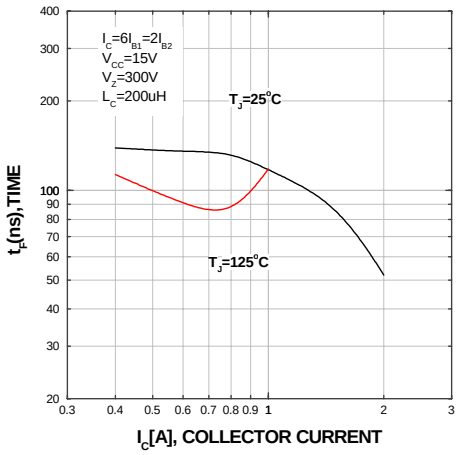



**Figure 13. Inductive Switching Time, $t_F$**

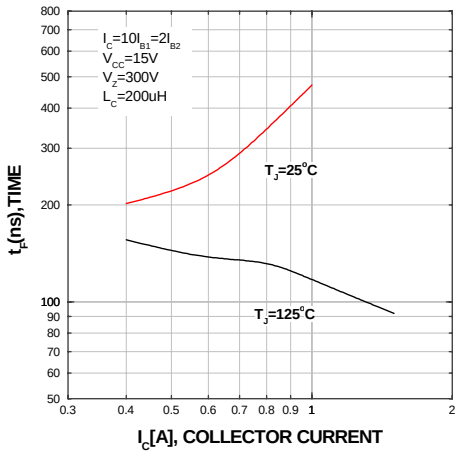



**Figure 14. Inductive Switching Time, $t_F$**

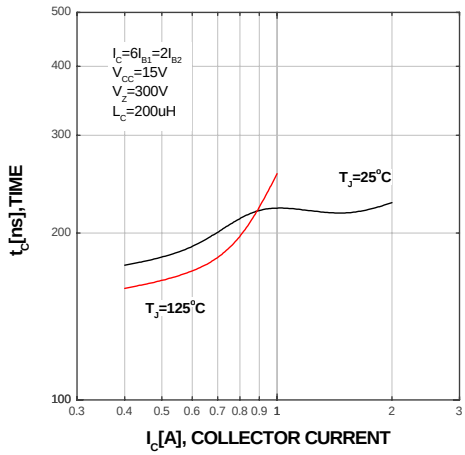



**Figure 15. Inductive Switching Time, $t_c$**

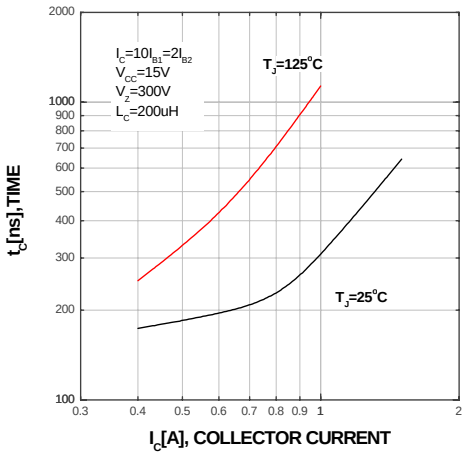



**Figure 16. Inductive Switching Time, $t_c$**

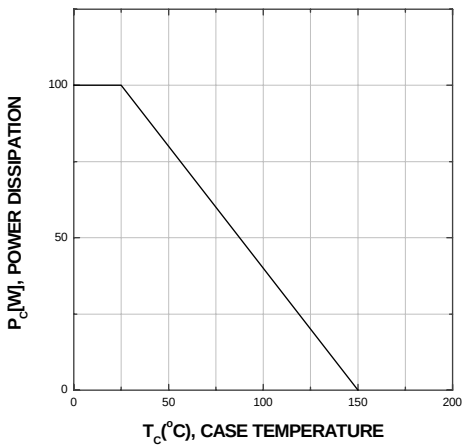



**Figure 17. Power Derating**

FAIRCHILD SEMICONDUCTOR®

## TRADEMARKS

The following are registered and unregistered trademarks and service marks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

| | | | |
|---|---|---|---|
| ACEx® | Green FPS™ | Power247® | SuperSOT™-8 |
| Build it Now™ | Green FPS™ e-Series™ | POWEREDGE® | SyncFET™ |
| CorePLUS™ | GTO™ | Power-SPM™ | The Power Franchise® |
| *CROSSVOLT*™ | *i-Lo*™ | PowerTrench® | the power franchise |
| CTL™ | IntelliMAX™ | Programmable Active Droop™ | |
| Current Transfer Logic™ | ISOPLANAR™ | QFET® | TinyBoost™ |
| EcoSPARK® | MegaBuck™ | QS™ | TinyBuck™ |
| | MICROCOUPLER™ | QT Optoelectronics™ | TinyLogic® |
| Fairchild® | MicroFET™ | Quiet Series™ | TINYOPTO™ |
| Fairchild Semiconductor® | MicroPak™ | RapidConfigure™ | TinyPower™ |
| FACT Quiet Series™ | MillerDrive™ | SMART START™ | TinyPWM™ |
| FACT® | Motion-SPM™ | SPM® | TinyWire™ |
| FAST® | OPTOLOGIC® | STEALTH™ | µSerDes™ |
| FastvCore™ | OPTOPLANAR® | SuperFET™ | UHC® |
| FPS™ | | SuperSOT™-3 | UniFET™ |
| FRFET® | PDP-SPM™ | SuperSOT™-6 | VCX™ |
| Global Power Resource$^{SM}$ | Power220® | | |

## DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

## LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

## PRODUCT STATUS DEFINITIONS

**Definition of Terms**

| Datasheet Identification | Product Status | Definition |
|---|---|---|
| Advance Information | Formative or In Design | This datasheet contains the design specifications for product development. Specifications may change in any manner without notice. |
| Preliminary | First Production | This datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design. |
| No Identification Needed | Full Production | This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design. |
| Obsolete | Not In Production | This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only. |

Rev. I31

littlediode
COMPONENTS FOR ALL

Littlediode supplies new, hard to find or obsolete electronic components and semiconductors all over the world.

With over two million different components listed you are sure to find the part you need.

Feel free to visit us today at our online store:

**LittleDiode.com**

Looking forward to providing you with the best possible service.